BROOKHAVEN NATIONAL LABORATORY Safety & Health Services Division **INDUSTRIAL HYGIENE GROUP** Standard Operating Procedure: Program Procedure	NUMBER **IH50900**
	FINAL rev4
SUBJECT: # IH Group's Environmental Management System Program	DATE **08/08/05**
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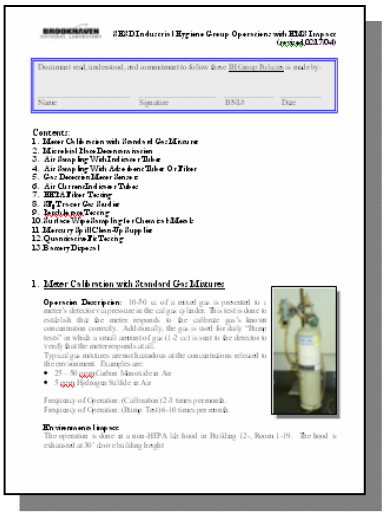

1.0 Purpose & Scope

This document describes the program of the SHSD Industrial Hygiene Group for compliance with BNL's *Environmental Management System (EMS)* for ISO14001. The purpose of the procedure is to establish an effective process to analyze the environmental impacts of new and existing IH Group operations. The program is used to validate regulatory compliance and to target program improvements.

Internal IH Group EMS Goals are:

- Minimize Impact on the Environment from IH Group Operations
  - Mechanism to Active Goal: Eliminate un-necessary operations that generate wastes/emissions; Select less hazardous alternatives whenever possible; Review the EMS Program and IH Group Impact Attachment on at least an basis to keep it current
- Maintain high level of Training and awareness of the IH Group environmental program
  - Mechanism to Active Goal: Conduct IH Group Employee training on at least a bi-annual basis.

2.0 Responsibilities

This procedure is administered through the SHSD Industrial Hygiene Group.

2.1 The IH Group Leader is responsible to:

2.1.1 Lead the creation of a compliant program.

2.1.2 Assess the IH Group's progress on the program, as necessary.

2.1.3 Assign IH staff to conduct operations covered by this program.

2.1.4 Ensure that the IH Staff follow the policies of this program.

2.2 This procedure is implemented through the SHSD Industrial Hygiene Group. The IH Group members are responsible to:

2.2.1 Read and understand the written IH Group's EMS program (see Attachment 9.1).

2.2.2 Conduct operations in accordance with this program.

3.0 Definitions

none

4.0 Prerequisites

none

5.0 Precautions

none

6.0 Procedure

6.1 **Equipment:** See items listed in ***Attachment 9.1.***

6.2 **Assessing the hazard of IH Group operations:** The IH Group Leader or IH Group staff identifies operations that need to be reviewed for EMS compliance. For new operations or operations that have not been adequately analyzed, the IH Group Leader will assign a person to review the operation and determine needed actions. New actions and the analysis will be added to ***Attachment 9.1.*** For each IH group operation, the impact on the environment impact, minimization, and waste management will be analyzed and an appropriate mechanism established.

6.3 **Annual Review:** In the fourth quarter of each year, the IH Group Leader will review the IH Group's EMS program and determine if new elements need to be added to Attachment 9.1. The review may be "collaborative" with ESWMD. Elements of this review will be the accuracy of ***Attachment 9.1*** and the staff's training on its contents.

6.4 **Employee Involvement**:

6.4.1 When new employees enter the IH Group, via new hire, temporary assignment, or reassignment, they will read or be instructed in the content of ***Attachment 9.1.***

6.4.2 When significant changes are made to ***Attachment 9.1,*** the IH Group Leader will forward the revised attachment to each IH Group employee.

6.4.3 Each employee will be expected to gain an understanding of the IH program and to sign their concurrence with policies set forth in ***Attachment 9.1.*** All staff will re-read Attachment 9.1 when significant changes are made.

7.0 Implementation and Training

7.1 **Qualification Criteria:** The IH Group Leader will instruct all IH staff in their role relative to this procedure, via formal sessions or "read-and-sign" instruction.

7.2 A written record of training will be maintained in the form of signed copies of Attachment 9.1 for each IH Group member.

8.0 References

BNL's ISO14001 *Environmental Management System (EMS).*

9.0 Attachments

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9.1 **Attachment 9.1:** ***SHSD Industrial Hygiene Group- Operations with EMS Impact***

10.0 Documentation

Document Development and Revision Control Tracking		
PREPARED BY: *(signature and date on file)* **R. Selvey** **Date 02/17/04**	**REVIEWED BY:** *(signature and date on file)* **J. Peters** **Date 02/18/04**	**APPROVED BY:** *(signature and date on file)* **R. Selvey** **IH Manager** **Date 02/27/04**
ESH Coordinator/ Date: *none*	Work Coordinator/ Date: *none*	SHSD Manager / Date *none*
QA Representative / Date: *none*	Training Coordinator / Date: *none*	Filing Code: **IH52.05**
Facility Support Rep. / Date: *none*	Environ. Compliance Rep. / Date: *none*	Effective Date: **02/27/04**
ISM Review - Hazard Categorization ☐ High ☒ Moderate ☐ Low/Skill of the craft	Validation: ☐ Formal Walkthrough ☒ Desk Top Review ☐ SME Review Name / Date:	IMPLEMENTATION: Training Completed: n/a Procedure posted on Web: 07/13/05 Hard Copy files updated: 07/13/05

Revision Log		
Purpose: ☐ Temporary Change ☐ Change in Scope ☐ Periodic review ☒ Clarify/enhance procedural controls Changed resulting from: ☐ Environmental impacts ☐ Federal, State and/or Local requirements ☐ Corrective/preventive actions to non-conformances ☐ none of the above Section/page and Description of change: Added Goals to Section 1; Added information on battery recycling in Attachment 9.1 Section 13.		
(signature/date on file) *R. Selvey* 06/08/04 SME Reviewer/Date:	Reviewer/Date:	Reviewer/Date:

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Purpose: ☐ Temporary Change ☐ Change in Scope ☐ Periodic review ☐ Clarify/enhance procedural controls Changed resulting from: ☐ Environmental impacts ☐ Federal, State and/or Local requirements ☐ Corrective/preventive actions to non-conformances ☐ none of the above Section/page and Description of change: Added change to battery disposal as universal waste, ozone generating devise, and Perchlorate sink disposal into Attachment 9.1.		
(signature/date on file) *R. Selvey* 09/01/04 SME Reviewer/Date:	Reviewer/Date:	Reviewer/Date:
Purpose: ☐ Temporary Change ☐ Change in Scope ☐ Periodic review ☒ Clarify/enhance procedural controls Changed resulting from: ☐ Environmental impacts ☐ Federal, State and/or Local requirements ☐ Corrective/preventive actions to non-conformances ☐ none of the above Section/page and Description of change: Added Respirator Cleaning to Attachment 9.1. Revised the format of Section 10.		
(signature/date on file) *R. Selvey 08/08/05* SME Reviewer/Date:	Reviewer/Date:	Reviewer/Date:
Purpose: ☐ Temporary Change ☐ Change in Scope ☐ Periodic review ☒ Clarify/enhance procedural controls Changed resulting from: ☐ Environmental impacts ☐ Federal, State and/or Local requirements ☐ Corrective/preventive actions to non-conformances ☐ none of the above Section/page and Description of change:		
(signature/date on file) SME Reviewer/Date:	Reviewer/Date:	Reviewer/Date:

Attachment 9.1

SHSD Industrial Hygiene Group-Operations with EMS Impact

(SEE NEXT PAGE)

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BROOKHAVEN NATIONAL LABORATORY

SHSD Industrial Hygiene Group Operations with EMS Impact
(IH50900 Attachment 9.1 Revision: 09/01/04)
HP-EMS-CAL IH Group Job Specific Environmental training

Document read, understood, and commitment to follow these IH Group Policies is made by:

Name	Signature	BNL#	Date
_____	_____	_____	_____

Contents:

1. Meter Calibration with Standard Gas Mixtures

Operation Description: 10-50 cc of a mixed gas is presented to a meter's detector via pressure in the cal gas cylinder. This test is done to establish that the meter responds to the calibrated gas's known concentration correctly. Additionally, the gas is used for daily "Bump tests" in which a small amount of gas (1-2 cc) is sent to the detector to verify the meter response.
Typical gas mixtures are not hazardous at the concentrations released to the environment. Examples are:

- 25 – 50 ppm Carbon Monoxide in Air
- 5 ppm Hydrogen Sulfide in Air

Frequency of Operation: (Calibration) 2-3 times per month.
Frequency of Operation: (Bump Test) 6-10 times per month.

Environmental impact:
The operation is done in a non-HEPA lab hood in Building 120-, Room 1-19. The hood is exhausted at 30' above building height.

- Gas mixture cylinders are used until empty. Empty cylinders are opened, vented in a hood to expel contents, purged with compressed air, and cylinder is recycled as metal scrap. Purged cylinder are taken to Building T-87 with a completed *Process Knowledge Form* for recycling. SOP for Cylinder Valve Removal is finalized as IH75190.
- Mercury is used to bump test the mercury meter. No mercury is consumed, as only the head space of a bottle is needed.
- Some chemicals may be used to create static bag mixtures of chemicals in air. Examples of chemicals used in the past have been carbon monoxide, benzene, and formaldehyde. In these cases, Tedlar bags are used to make mixtures of known concentration. At the completion of testing, these bag mixtures are exhausted up the hood. Concentrations are typically 1-100 ppm in air; volume is 1 to 10 liters of mix.

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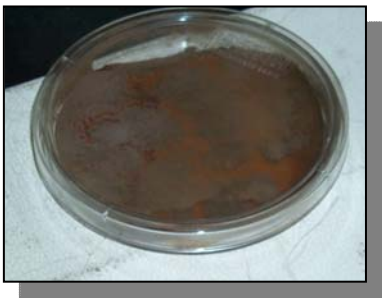
2. Microbial Sampling Plate Decontamination



Operation Description: Agar plates are exposed to ambient air in suspect IAQ investigations in buildings. This test concentrates naturally occurring microbes. Plates are either sent off site for counting or are held at BNL for colony growth. For plates at BNL, at the end of analysis, the plates are decontaminated by chemical disinfection. Frequency of Operation: 2-3 times per year

Environmental impact:
Decontamination is done with 50/50 mix of household bleach and water. Plates are soaked for 2-3 days. At the end of disinfection, the colonies are no longer viable. Slurry is discharged to the sanitary system (typically flushed in a toilet because the agar will still have the consistency of moist gelatin). Approximately 1 gallon of 50/50 bleach/water is generated in the disinfection process.

This method is also used on un-exposed plates that have expired yet show signs of microbial growth.

Plates that have expired but are still sterile, and disposed on in the non-hazardous trash.

Conformance of proper disposal by the off-site vendor laboratory is validated to BNL IH Group's satisfaction in the AHIA Accreditation process.

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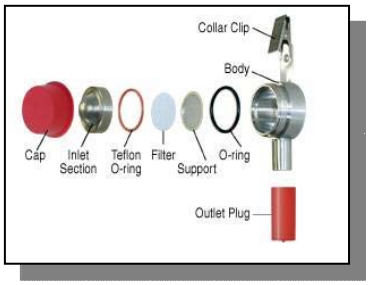
3. Air Sampling With Indicator Tubes

Operation Description: *Glass Indicator tubes* are taken into the field to measure ambient air concentrations of certain contaminants. The tubes contain small quantities of reactive chemicals (ppm to low % range) on a support media. Content of the chemicals on the tube is known via the manufacturer's published handbook.
Frequency of Operation: 0-1 times per year.

Environmental impact:
At end of the test, the used tubes are returned to the IH lab and held for disposal as hazardous waste. Out of date tubes are handled the same. The content of chemicals in the tubes, listed in the manufacturer's published handbook or MSDS, is recorded on the ESWMD Hazardous Waste form. Policy is documented in SOP IH IH75170 and IH75175.

4. Air Sampling with Adsorbent Tubes or Filter



Operation Description: Ambient air is drawn through glass tubes with an adsorbent or filters to collect chemicals in the ambient air. The tubes or filters are sent to AIHA Accredited laboratories off-site for analysis. The tubes and filters are disposed by those facilities in accordance with regulatory regulations that is verified in the AIHA Accreditation validation.
Frequency of Operation: 10-20 times per month for collection of samples to be sent off-site.

Environmental impact:
No environmental impact at BNL. Disposal is handled by off-site vendor laboratory. Conformance of proper disposal by the off-site vendor laboratory is validated to BNL IH Group's satisfaction in the AHIA Accreditation process.
When unused media (that is treated by the manufacturer) has expired, it is disposed of as per the manufacturer's instruction.

5. Gas Detection Meters Sensors

Operation Description: Gas Detection Meters (such as the *Bacharach® Sentinel 44, Crowcon® Triple Plus, or Scott® Scout*) are taken into the field to measure ambient air concentrations of certain contaminants. Sensors contain reactive chemicals (in the ppm to low % range). Content is known via the manufacturer's MSDS or meter's Operating Manual.

Field Testing is done by SHSD and RCD personnel.
Frequency of Operation: 10-40 days per year.

On a periodic basis, the sensors need to be replaced. They are removed by SHSD IH.
Frequency of Operation: Approximately 30 sensors are changed per year.

Environmental impact:
- At end of the field test, the meters are returned to the IH lab. No environmental impact results because the meters do not produce emissions.
- When the sensors in the meters need to be replaced, they are removed by the SHSD IH Technician. They are disposed of as non-hazardous waste, as per manufacturer's recommendations. Policy is documented in a SOP IH75180.
- The *Perkin-Elmer Photovac Voyager* portable gas chromatograph (GC) has a carrier gas of ultra-pure nitrogen that continuously flows over the GC column and sensor at <5 cc/min.

The nitrogen gas is exhausted to the atmosphere. It is not considered hazardous as it is incapable of depleting the oxygen levels to a hazardous level to room occupants. Nitrogen is the chief ingredient in atmospheric air and the concentration of the environment is not measurably impacted by this small release.

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6. Air Current Indicator Tubes

Operation Description: *Smoke tubes* (i.e. air direction indicators) contain Stannic Chloride that reacts with humidity in the air to form Hydrogen Chloride and a visually detectable Tin Oxide.

The tubes are taken into the field when air velocity measurements are made to indicate the direction of air flow.
Frequency of Operation: 4 times per year; 5-8 tubes.

The same tubes are used for Qualitative Fit testing (QLFT).
Frequency of Operation: 1 times per year; 1 -2 tubes.

Environmental impact:
At end of the test, the tubes are returned to the IH lab and held for disposal as hazardous waste as per the manufacturer's MSDS guidance.

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7. HEPA Filter Testing

Operation Description: 100 -500 cc of Emery 3004 (poly-alpha-olefin) is injected into a HEPA filtered exhaust ventilation system during testing. Penetration of this challenge agent through the filter is measured downstream of the injection site and filter.
Frequency of Operation: 2-3 times per month

Environmental impact:
The IHG operation converts all the Emery 3004 into an aerosol with compressed air. In a test of a passing filter, the aerosol is trapped on the filter. In a system with a failed filter, some or all of the aerosol is discharged to the environment up the exhaust stack. The concentration of aerosol in the exhaust air has negligible environmental consequences.

The Emery 3004 purchased by the IHG is used until it is all consumed in testing. If needed, the Emery 3004 would be disposed of as a hazardous liquid via ESWMD. The filter testing policy is documented in approved SOPs IH62300 and IH62350.

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8. SF_6 Tracer Gas Studies

Operation Description: Sulfur Hexafluoride (a low toxicity gas) is injected into a HVAC system or building to detect air flow patterns, exchange rates, infiltration, etc.
Frequency of Operation: 0-1 times per year

Environmental impact:
The SF6 is considered a low hazard to occupants. In a test, the gas is released in concentrations that result in a few ppb within the building volume of air. All of the gas is eventually discharged to the environment via exhaust stacks, HVAC, or infiltration from the building by natural air currents and occupant movement in and out of the building.

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9. Perchlorates in Hoods Testing

Operation Description: 0- 2000 ppm calibration solutions of Perchloric Acid in Ammonium Sulfate solution are made. Field samples with potential Perchlorates (in distilled water) are tested with a specific ion conductivity probe. The meter response for samples is compared to the calibration standards. In each batch of tests, 0.173 ml of Perchloric acid and 26 g of ammonium sulfate are used.
Frequency of Operation: 1-4 times per year

Environmental impact:
At end of the test, the ammonium sulfate/perchlorate solutions are sink disposed with copious amounts of water for safety reasons. Disposal of the solutions by dilution in large amounts of water is by far the safest disposal method and has negligible environmental consequences. Once diluted into BNL's waste water system's volume, all risk of the reactivity/explosion hazard is eliminated. Policy is documented in IHG SOP IH75200. As per "Liquid Effluent Evaluation Form" dated 08/30/04, if analysis of field samples are conducted in a period when the BNL Sanitary treatment Plant is experiencing elevated levels of Perchlorates, permission for sink release will be suspended and the samples will need to be containerized for waste disposal. For PPE used during testing or analysis, washing the outer surfaces over a sanitary sink is appropriate. The PPE can then be disposed of in the non-hazardous trash.

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10. Surface Wipe Sampling for Chemicals/Metals

Operation Description: Field samples for potential metals or chemicals are collected on pre-moistened pads. This process concentrates toxic substances on the media. The wipes are either sent off-site for analysis or in some instances are analyzed at BNL by the IH group using direct reading meters.
Frequency of Operation: 2-3 times per year

Environmental impact:
For the few wipes analyzed at BNL, at the end of test, the wipes are disposed of as non-hazardous waste. This is justified because the concentration is too low to be of concern (a few micrograms per wipe cloth). Frequency of Operation: 0-1 times per year.

For PPE used during testing or analysis, the PPE and paper template are disposed of as non-hazardous waste. This is justified because the concentration is too low to be of concern (a few micrograms per wipe surface).

Conformance with proper wipe disposal by the off-site vendor laboratory is validated to BNL IH Group's satisfaction in the AHIA Accreditation process.

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11. Mercury Spill- Area Clearance Testing

Operation Description: In the event of a mercury spill at BNL, the IH Group has prepared a plan for testing the spill area to determine if the area can be re-occupied. The IH procedure calls for spreading a "Mercury Indicator" which is a dry powder mixture of Cuprous Iodide, Sulfur, Starch, and Silica. In the presence of mercury, the indicators changes color.
Frequency of Operation: 0-1 times per year

Environmental impact:
At end of the test, the "Mercury Indicator" is vacuumed by the Plant Engineering staff who are abating the incident. The powder disposal is via ESWMD along with the collected mercury and adsorbents by Plant Engineering. The spill clean up procedure is documented in IHG SOP 75135.

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12. Quantitative Fit Testing

Operation Description: Minute quantities of Isopropanol (4 ml per month) are mixed with ambient air in the Portacount® Fit Test Apparatus to create an alcohol coating on ambient dust particles. These enhanced particles can then be detected by the meter. The exhaust from the meter is vented into the fit test room.
Frequency of Operation: 2-8 times per week; <50 ml of Isopropanol per year.

Environmental impact:
This generation has negligible environmental consequences. The concentration of Isopropanol in the room is below any level of detection and is not hazardous. No controls are in place or are required. The fit test procedure is documented in IHG SOP IH72350.

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13. Battery Disposal

Operation Description: Several IHG meters and pumps operate with Nickel/Cadmium, Nickel Metal Hydride, or lead acid batteries. When needed, the batteries are replaced in the equipment. Some of the battery components pose an environmental hazard.
Frequency of Operation: 10 times per year; 25 batteries.

Environmental impact:
At end of the battery life, the batteries are handled as follows:

- *Ni-Cad* batteries are processed through ESWMD for disposal as Industrial waste. *SKC Model 224* batteries will be processed to *Heck-Technical Resources, Inc* for rebuilding, when appropriate.
- *Ni-MH* batteries are processed through ESWMD for disposal as Industrial waste.
- *Lead Acid* batteries processed through ESWMD for disposal as Industrial waste.
- *Alkaline* batteries are disposed in the non-hazardous waste trash.
- *Carbon* batteries are disposed in the non-hazardous waste trash.

14. Chemical Management System- Coding of Chemicals at Receiving Warehouse

Operation Description: On a daily basis the CMS team goes to the PPM Receiving Warehouse to record and bar code chemical shipments. Chemical containers are not opened but outer packaging may be opened to place a bar code sticker on chemical containers. The chemical container is not opened and no chemicals are release during the bar coding process. Emergency Response will be activated, if in the course of this work,

- A container is broken by a CMS member or
- A CMS or PPM member observes a package with signs of leakage.

Environmental impact:
A leaking or broken container could injure CMS worker, PPM worker, or the environment.

In case of spill or release causing a significant risk to workers or the environment, the CMS team member will:

- Warn other personnel in the area,
- Call 911 to initiate the emergency response team, and
- Notify the PPM supervisor.

In case of minor leakage (such as found cap loose or box or packing is wet), the CMS team member will:

- Notify the Emergency Services Division Supervisor on watch for a tailored response to the incident and
- Notify the PPM supervisor.
- If it can be done safely, isolate the leaking or broken container and place it in a secondary container.

15. Ozone generation during Indoor Air Quality Complaints

Operation Description: On an occasional basis (1-4 times per year), an IH group professional may respond to an Indoor Air Quality complaint of "mold" odors. In these instances, an International Ozone TZ-2 or TZ-BB1 Electronic Odor Control System can be used to generate ozone in room to neutralize unpleasant odors. The TZ-2 is capable of generating ozone levels at the rate of 3000 mg/hour. For a typical size office (12' x 15' x 8' = 40m^3) the resulting concentration will be temporary levels of up to 75 mg/m^3 or 40 ppm range. The half life of ozone is 20 minutes, after which it reverts back to oxygen. The TZ-BB1 is much smaller an only generates sub-ppm levels of ozone.

Environmental impact:
Indoor atmospheric concentrations of ozone are temporarily generated in the 0.01 to 50 ppm range. The ozone is generated indoors and reverts back to oxygen naturally within about a half hour. There are no releases to the atmosphere unless the room has a ventilation exhaust. These are typically turned off, because the intent of the ozone treatment is to generate a concentration of ozone in the room. Based on an email form EWMSD dated 8/26/04, this operation does not need to be permitted pursuant to 6NYCRR 201-3.2(c.)(45).

16. Cleaning of Fit Test Respirators

Operation Description: After each fit test, the mask worn by the subject must be sanitized in preparation for the next user. The IH Group disinfects the masks in Building 120, Room 1-19. The masks are disassembled and placed in an aqueous germicidal detergent solution. The product is Georgia Steel "*Special Respirator Cleaner Plus*", product number FK300. The cleaner contains Active ingredients of Alkyl (C12, c14, and c18) dimethyl benzyl ammonium chloride (5.63%), Octyl decyl dimethyl ammonium chloride (4.22%), Didecyl dimethyl ammonium chloride (2.85%) and Dioctyl dimethyl ammonium chloride (2.11%). The ratio of mixing the detergent into warm tap water is 1 to 256 (1 once per gallon.) The measuring & dispensing of the detergent is via a pre-measured filling mechanism in the cleaner bottle. The respirators are soaked in the detergent solution and then rinsed in the sink with tap water. The used detergent solution is released into the sink drain and flushed with tap water.

Environmental Impact:
This operation has negligible environmental consequences. The concentration of germicidal detergent is similar to that of consumer over-the-counter antimicrobial hand soaps. No controls are in place or are required. The fit test cleaning procedure is documented in IHG SOP IH72450.